Invoice

Robert Law

LPR/NB Hydrodynamic Model **Professional Personnel**

Senior Engineer/Scientist

P.O. Box 22648

Long Beach, CA 90801-5648 Phone: (562) 590-6500

October 26, 2015

De Maximis Inc. Invoice No: 714017 186 Center Street, Suite 290 Clinton, NJ 08809 6664-04 Lower Passaic River/Newark Bay Modeling Project Professional Services from August 30, 2015 to September 26, 2015 LPR/NB Modeling Program NB Model of the LPR/NB Task Coordination and Meetings Coordination and Meetings **Professional Personnel** Hours Rate Amount Senior Engineer/Scientist 11.00 209.00 2,299.00 Engineer/Scientist II 5.50 172.00 946.00 Totals 16.50 3,245.00 **Total Labor** 3,245.00 **Total this Task** \$3,245.00 Task 03 System Understanding System Understanding **Professional Personnel** Hours Rate Amount Senior Engineer/Scientist 4.00 209.00 836.00 Engineer/Scientist II 42.00 172.00 7,224.00 Staff Engineer/Scientist 40.00 119.00 4,760.00 Totals 86.00 12,820.00 **Total Labor** 12,820.00 **Total this Task** \$12,820.00 LPR/NB Hydrodynamic Model

Hours

4.00

Rate

209.00

Amount

836.00

Staff E	ngineer	/Scier	ıtist
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52.00 119.00 6,188.00 Totals 56.00 7,024.00

Total Labor 7,024.00

Total this Task \$7,024.00

\$35,684.00

TOTAL THIS INVOICE

LPR/NB Sediment Transport Model			
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Hours	Rate	Amount	
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1.00	209.00	209.00	
30.50	172.00	5,246.00	
	119.00	•	
91.50		12,595.00	
			12,595.00
	Total th	is Task	\$12,595.00
	Total this	s Phase	\$35,684.00
	LPR/NB Sediment Transport Model Hours 1.00 30.50 60.00 91.50	Hours Rate 1.00 209.00 30.50 172.00 60.00 119.00 91.50 Total th	Hours Rate Amount 1.00 209.00 209.00 30.50 172.00 5,246.00 60.00 119.00 7,140.00

ACH Payment Remittance Information Bank Account Name: Moffatt & Nichol

Bank Number: 4159349729

Routing: 121000248

Project	6664-04	Lower Passaic River/Newark Bay Modeling	Invoice	714017	

Billing Backup

Friday, October 30, 2015

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Moffatt & Nichol

Invoice 714017 Dated 10/26/2015

	6664-04		I TIVEI/INEWAIK I	Bay Modeling		
LPR/NB I	Modeling Program	NB Model of the LPR	/NB			
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Coordinat	ion and Meetings					
Profession	onal Personnel					
			Hours	Rate	Amount	
Senior En	gineer/Scientist					
1548	Canizares, Rafael	8/31/2015	1.50	209.00	313.50	
1548	Canizares, Rafael	9/1/2015	.50	209.00	104.50	
1548	Canizares, Rafael	9/8/2015	2.00	209.00	418.00	
1548	Canizares, Rafael	9/9/2015	4.00	209.00	836.00	
1548	Canizares, Rafael	9/14/2015	1.00	209.00	209.00	
1548	Canizares, Rafael	9/22/2015	2.00	209.00	418.00	
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2219	Mathew, Rooni	9/15/2015	1.00	172.00	172.00	
2219	Mathew, Rooni	9/16/2015	.50	172.00	86.00	
2219	Mathew, Rooni	9/17/2015	2.00	172.00	344.00	
2219	Mathew, Rooni	9/18/2015	2.00	172.00	344.00	
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6664-04	Lower Passaic Rive	r/Newark Bay Mo	odeling	Invoice	714017
Manian, Dinesh	9/15/2015	8.00	119.00	952.00	
Manian, Dinesh	9/21/2015	8.00	119.00	952.00	
Manian, Dinesh	9/22/2015	8.00	119.00	952.00	
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Canizares, Rafael	9/14/2015	2.00	209.00	418.00	
Canizares, Rafael	9/22/2015	.50	209.00	104.50	
Canizares, Rafael	9/23/2015	.50	209.00	104.50	
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Manian, Dinesh	9/1/2015	8.00	119.00	952.00	
Manian, Dinesh	9/8/2015	8.00	119.00	952.00	
Manian, Dinesh	9/14/2015	8.00	119.00	952.00	
Manian, Dinesh	9/16/2015	8.00	119.00	952.00	
Manian, Dinesh	9/17/2015	4.00	119.00	476.00	
Manian, Dinesh	9/23/2015	8.00	119.00	952.00	
Manian, Dinesh	9/24/2015	8.00	119.00	952.00	
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91.50

Totals

Total Labor

12,595.00 Page 2

12,595.00

Project	6664-04	Lower Passaic River/Newark Bay Modeling	Invoice	714017
		Total t	his Task	\$12,595.00
		Total th	is Phase	\$35,684.00
		Total this	s Project	\$35,684.00
		Total this	s Report	\$35,684.00



(212) 768-7454 Fax (212) 768-7936

Detailed Description of work done by M&N personnel associated to the LPR/NB Modeling Program HD/ST Newark Bay Model - Scope of Work for the period 08/30/2015 to 09/26/2015 M&N Project No. 6664

Hydrodynamics Principal Investigator - Rafael Cañizares.

Task 1 – Project Management	 Internal coordination with Deltares and M&N, tasks to be completed Prepare and review July invoice Internal project accounting. Review with Deltares invoicing. Internal discussion with Dinesh Manian regarding project tasks Review invoice Internal coordination Internal coordination with Deltares for invoice
Task 3 – LPR/NB System Understanding	Review and update System Understanding report
Task 4 – LPR/NB Hydrodynamic Modeling	 Discuss and review model results and approach for calibration Discuss calibration procedure and model improvements.
Task 5 – LPR/NB Sediment Transport Modeling	Internal discussion and review of ST model developments

Rooni Mathew.

Task 1 – Project Management	 Compile material to share with AQEA and respond to AQEA's questions Respond to HQI conference call on PWCM data Respond to HQI questions on PWCM data
Task 3 — System Understanding	 Review velocity profiles from Bob Chant & PWCM deployments, review tide/current deformation and lag data, review comparisons to tide, wind, discharge data Develop./finalize hydro calibration metrics based on PWCM/Chant data analysis, review model performance, develop/review sensitivity tests Develop/review wind-wave shear stress environment and statistics
	Develop/review wind-wave shear stress environment and statistics, compare to sediment GSD data



	 Develop wave shear stress statistics and maps, compare wave shear stresses to sediment substrate Finish wave shear stress and surface GSD comparisons, review with H.Winterwerp Review wave model skin friction with H.Winterwerp, review system understanding document Develop. Re-entrainment rate analysis for NB
Task 5 – LPR/NB Sediment Transport Modeling	 Review & debug wind-wave runs w ST Review/finalize codes for wind-wave shear stress calculations and combined current/wave shear stress, process/review ST run with Hackensack River changes, wind-waves Review HQI suggested sensitivity runs for Hackensack River/Meadowlands, review ST run with Hackensack River Develop revised bathy inputs and launch ST run with revised Hackensack River geometry/friction Review progress of ST run with revised grid/friction

Dinesh Manian

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Task 3 – System	Computing sediment flux at KVK based on Chant's 2001-02
Understanding	data; Updated sediment flux based on Chant's 2008-09
	sediment and bathy data (post-deepening);
	Evaluating wave model results; Annual wave rose plots at
	different locations; comparison with wind data for the same period
	Preparing presentation summarizing understanding of system processes, and model performance
	Preparing summary presentation for internal review of HD
	model calibration for Newark Bay; Including data analysis,
	wave model, and model-data comparisons
	Preparing summary presentation for internal review of HD model calibration for Newark Bay; Including data analysis, wave model, and model-data comparisons
Task 4 – LPR/NB	HD calibration: Processing sensitivity runs to Meadowlands
Hydrodynamic Modeling	connection; Model-data comparison of the time-series of
	phase difference between slack-water at LPR and Hackensack
	HD calibration: Additional Sensitivity runs to Meadowlands
	connection w Hackensack; Model-data comparison of the
	time-series of velocity phase difference between Passaic and
	Hackensack
	HD calibration Sensitivities to meadowlands bathymetry



	HD calibration: Processing time-series of slack-water phase- difference in the model: Comparison with data.
	difference in the model; Comparison with data
	HD calibration: Additional sensitivities to bottom-friction and
	Meadowlands bathymetry
	Setting up long-term hydrodynamic simulations with full grid
	with revised Hackensack bathymetry
	• QA/QC and understanding wave model results; Time-series of
	wave-maps, and correlation with winds
Task 5 – LPR/NB	Developing model-data comparison in Newark Bay with
Sediment Transport	Chant's 2008-09 and Spring PWCM data;
Modeling	• Setting up tabulation of sediment mass balance in the model in
	Newark Bay
	• Setting up tabulation of annual sediment mass balance in the
	model in Newark Bay
	• Debugging ST code with waves;
	 Debugging ST code with waves; Assessing model
	performance with updated code
	• Understanding ST model performance with waves; Processing
	time-series of maps of wave-heights and shear-stresses
	Processing ST model mass-balance in Newark Bay
	Processing final ST model run with waves